

ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE (CAP. 499)
SECTION 5 (7)

ENVIRONMENTAL IMPACT ASSESSMENT STUDY BRIEF NO. ESB-227/2011

PROJECT TITLE : DRAINAGE IMPROVEMENT WORKS
AT NGONG PING
(hereinafter known as the "Project")

NAME OF APPLICANT : DRAINAGE SERVICES DEPARTMENT
(hereinafter known as the "Applicant")

1. BACKGROUND

- 1.1 An application (No. ESB-227/2011) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 14 April 2011 with a project profile (No. PP-437/2011) (the Project Profile).
- 1.2 The Project is to carry out drainage improvement works at Ngong Ping of Lantau Island to improve the existing drainage system in accordance with the recommendation of the "Drainage Study for Ngong Ping" so as to reduce the flood risk in Ngong Ping area. The General Layout Plan (No. DDN8837) as given in the Project Profile is reproduced in Figure 1 of this Study Brief. The works under the Project includes the following:-
- (i) Construction of new underground drainage pipe of approximately 450m in length and 2.5m in average base width at the northern side of the Po Lin Monastery;
 - (ii) Construction of new box culvert of approximately 230m in length and 4 to 5m in average base width at north-western side of the Po Lin Monastery near Lin Ping Drive; and
 - (iii) Construction of new underground drainage pipe of approximately 220m in length and 3m in average base width at the northern side of Ngong Ping Cable Car Terminal and Columbarium.
- 1.3 The Project involves drainage works which constitutes the following designated projects under Part I, Schedule 2 of the EIAO:
- (i) Item I.1(b)(i) --- A drainage channel which discharges into an area which is less than 300m from the nearest boundary of an existing site of special scientific interest;
 - (ii) Item I.1(b)(vii) --- A drainage channel which discharges into an area which is less than 300m from the nearest boundary of an existing conservation area; and
 - (iii) Item Q.1 --- Earthworks and other building works partly or wholly in an existing country park.

- 1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this EIA study brief to the Applicant to carry out an EIA study.
- 1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and associated works that take place concurrently. This information will contribute to decisions by the Director on :
- (i) the acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
 - (ii) the conditions and requirements for the design, construction and operation of the Project to mitigate against adverse environmental consequences; and
 - (iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

2 OBJECTIVES OF THE EIA STUDY

2.1 The objectives of the EIA study are as follows :

- (i) to describe the Project and associated works together with the requirements and environmental benefits for carrying out the Project and the types of designated projects to be covered by the Project;
- (ii) to identify and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including natural and man-made environment and the associated environmental constraints;
- (iii) to provide information on the consideration of alternative design options of the Project including scale, extent, layout, configuration, design and type of design orientation and the construction methods with a view to avoiding or minimizing potential environmental impacts to environmentally sensitive areas and sensitive uses; to compare the environmental benefits and disbenefits of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);
- (iv) to identify and quantify emission sources (including air quality, noise, water quality and waste, etc. as appropriate) and determine the significance of impacts on sensitive receivers and potential affected uses;
- (v) to identify and quantify any potential loss or damage and other potential impacts to ecology, flora, fauna and natural habitats and to propose measures to mitigate these impacts;
- (vi) to identify any potential landscape and visual impacts and to propose

- measures to mitigate adverse impacts;
- (vii) to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;
 - (viii) to propose provision of mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
 - (ix) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
 - (x) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
 - (xi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;
 - (xii) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification; and
 - (xiii) to design and specify environmental monitoring and audit requirements to check the effective implementation of the recommended environmental protection and pollution control measures.

3 DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The Purpose

- 3.1.1 The purpose of this study brief is to scope the key issues of the EIA study and to specify the environmental issues that are required to be reviewed and assessed in the EIA report. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as “the TM”) are complied with.

3.2 The Scope

- 3.2.1 The scope of this EIA study shall cover the Project and associated works proposed in the Project Profile and mentioned in Section 1.2 above. The EIA study shall address the likely key issues described below, together with any other key issues identified during the course of the EIA study:
 - (i) The potential impact to water quality and ecological habitat due to the

discharge of stormwater and surface runoff during the construction and operational phases, taking into account the cumulative impact from the construction of existing and planned/committed projects in the vicinity of the Project;

- (ii) The potential aquatic and terrestrial ecological impacts arising from the construction and operational phases, including loss and modification of habitats, removal of vegetation, the impact and disturbance to animals and plants. The assessment shall identify and evaluate all direct, indirect and cumulative impacts resulting from the proposed Project during the construction and operational phases, including any subsequent regular maintenance works. Any adverse impacts shall be fully addressed and mitigated. The design of the drainage system shall take into account established and new environmental friendly design concept to minimize the ecological impacts;
- (iii) The potential landscape and visual impacts during construction and operation of the Project, in particular the potential landscape impacts from the Project on the nearby sensitive receivers, including residents and tourists in Ngong Ping area;
- (iv) The potential impacts of various types of wastes to be generated from the construction and operation of the Project, in particular the spoil arising from the proposed drainage works during construction and maintenance desilting. The potential waste management issue associated with the use of filling materials such as inert construction and demolition material (C&DM) during construction of the Project shall be addressed;
- (v) The potential air quality and noise impacts on the sensitive receivers of Ngong Ping during construction of the Project, in particular at the village houses and other residential premises located near the Project site;
- (vi) The potential cultural heritage impacts caused by the Project;
- (vii) The potential cumulative impacts of the Project, through interaction or in combination with other existing, committed and planned projects in the vicinity of the Project; and
- (viii) Any potential impact on environmental mitigation measures proposed under the Tung Chung Cable Car Project - Diversion of the Ngong Ping Stream as detailed in the Project Profile (Register No. PP-193/2003) and the environmental permit (Register No. EP-192/2004).

3.3 Consideration of Alternatives

3.3.1 Need of the Project

The Applicant shall provide information on the need of the Project, including the purpose, objectives and environmental benefits of the Project, and describe the scenarios with and without the Project.

3.3.2 Consideration of Different Development Options

The Applicant shall present information on identified feasible alternatives and the proposed development option(s), taking into account any relevant studies relating to the proposed drainage improvement works, the relevant findings of those options addressed in previous studies as well as any studies conducted to reflect the latest changes and developments identified during the course of this EIA study. The Applicant shall provide information on the consideration of alternatives/options for alignment, scale, size, location, scope, shape, configuration and design of the Project.

3.3.3 Consideration of Alternative Construction Methods and Sequences of Works

Taking into consideration of the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, alternatives and options shall be explored to avoid or minimize the potential adverse environmental impacts on the sensitive uses within and close to the Project area, e.g. different construction methods, sequences of works, phased implementation of the Project, work programme and methods for transportation of construction and demolition materials, to avoid or minimize adverse environmental impacts. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequences of works shall be included in the EIA study.

3.3.4 Selection of Preferred Scenarios

Taking into consideration of the findings above, the Applicant shall recommend with justifications the adoption of the preferred scenario that will avoid or minimise adverse environmental effects arising from the Project, and describe the part that environmental factors played in arriving at the final selection.

3.4 **Technical Requirements**

3.4.1 The Applicant shall conduct the EIA study to address the environmental aspects described in Sections 3.1, 3.2 and 3.3 above. The assessment shall be based on the best and latest information available during the course of the EIA study. The Applicant shall include in the EIA report details of the construction programme and methodologies. The Applicant shall assess the cumulative environmental impacts from the Project and interacting projects as identified in the EIA study. The EIA study shall include the following technical requirements on specific impacts.

3.4.2 **Air Quality Impact (Construction phase only)**

3.4.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in section 1 of Annex 4 and Annex 12 of the TM.

3.4.2.2 The assessment area for air quality impact assessment shall be defined by a distance of 500 meters from the boundary of the Project site, with consideration to be extended to include major existing, planned and committed air pollutant emission sources that may have a bearing on the environmental acceptability of the Project. Air sensitive receivers of Ngong Ping shall be included and assessed in the air

quality impact assessment.

3.4.2.3 The air quality impact assessment for construction of the Project shall follow the detailed technical requirements given in Appendix A.

3.4.3 Hazard to Life

Not used

3.4.4 Noise Impact (Construction phase only)

3.4.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM.

3.4.4.2 The assessment area for the noise impact assessment shall generally include areas within 300m from the boundary of the Project site. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300m from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. The assessment area shall be expanded to include NSRs at distances over 300m from the Project which are affected by the construction of the Project. NSRs in Ngong Ping shall be included and assessed in the noise impact assessment.

3.4.4.3 The noise impact assessment for construction of the Project shall follow the detailed technical requirements given in Appendix C.

3.4.5 Water Quality Impact

3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as stated in Annexes 6 and 14 of the TM.

3.4.5.2 The study area for the water quality impact assessment shall include all areas within 500m from the Project site boundary, including the Ngong Ping River. The study area shall be extended to include other areas if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project. The following sensitive receivers and other sensitive receivers identified during the course of the EIA study shall be included and assessed in the water quality impact assessment:

- natural streams and rivers in and near Ngong Ping, including Ngong Ping Stream; and
- areas of ecological or conservation value at Ngong Ping, including the Lantau North Country Park, Conservation Area (CA) and the Ngong Ping Site of Special Scientific Interest (SSSI).

3.4.5.3 The water quality impact assessment for construction and operation of the Project shall follow the detailed technical requirements given in Appendix D.

3.4.6 Waste Management Implication

3.4.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implication as stated in Annexes 7 and 15 of the TM respectively.

3.4.6.2 The assessment of the waste management implication arising from construction and operation of the Project shall follow the detailed technical requirements given in Appendix E.

3.4.7 Ecological Impact

3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM.

3.4.7.2 The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500m from the Project site boundary and any other areas likely to be impacted by the Project. For aquatic ecology, the assessment area shall be the same as the assessment area for water quality impact assessment and shall also include any other areas likely to be impacted by the Project. Areas of ecological or conservation values in Ngong Ping shall be included and assessed in the ecological impact assessment.

3.4.7.3 The ecological impact assessment for construction and operation of the Project shall follow the detailed technical requirements given in Appendix F.

3.4.8 Fisheries Impact

Not used

3.4.9 Landscape and Visual Impacts

3.4.9.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM and the EIAO Guidance Note No.8/2010 on "Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance" for evaluating and assessing the landscape and visual impacts.

3.4.9.2 The assessment area for landscape impact assessment shall include areas within a 500m distance from the site boundary of the Project. The assessment area for the visual impact assessment shall be defined by the visual envelope of the Project.

3.4.9.3 The landscape and visual impact assessments for construction and operation of the Project shall follow the detailed technical requirements given in Appendix H.

3.4.10 Impact on Sites of Cultural Heritage

3.4.10.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impacts as stated in Annexes 10 and 19 of the TM.

3.4.10.2 The Applicant shall engage an archaeologist to review information about the study area of the Project to identify whether there is any possible existence of sites or

remains of archaeological interest that will be affected by the construction works of the Project. If the review result reveals the existence of such possibility, an Archaeological Survey will be required to further assess the archaeological potential of the study area. Should sites or remains of archaeological interest be identified during the survey, appropriate mitigation measures should be designed and implemented prior to the commencement of any construction works. The Archaeological Survey should be conducted by an archaeologist who shall obtain a licence from the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap 53), and the detailed assessment shall follow the technical requirements given in Appendix I.

3.4.11 Summary of Environmental Outcomes

3.4.11.1 The EIA report shall contain a summary of key environmental outcomes arising from the EIA study, including environmental benefits of the Project and the environmental protection measures recommended, population and environmentally sensitive areas protected, recommended environmentally friendly designs, key environmental problems avoided and any compensation areas included.

3.4.12 Environmental Monitoring and Audit (EM&A) Requirements

3.4.12.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during the construction and operation phases of the Project and, if affirmative, define the scope of EM&A requirements for the Project in the EIA study.

3.4.12.2 Subject to the confirmation of the EIA study findings, the Applicant shall follow the guidelines for an EM&A programme as stated in Annex 21 of the TM.

3.4.12.3 The Applicant shall prepare a Project Implementation Schedule in the form of a checklist as shown in Appendix J of this EIA study brief. It shall contain the EIA study recommendations and mitigation measures with reference to the implementation programme.

4. DURATION OF VALIDITY

4.1 The Applicant shall notify the Director of the commencement of the EIA study. If the EIA study does not commence within 36 months after the date of issue of this EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study.

5. REPORT REQUIREMENTS

5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for the review of an EIA report.

5.2 The Applicant shall supply the Director with hard and electronic copies of the EIA report and the executive summary in accordance with the requirements given in Appendix K. The Applicant shall, upon request, make additional copies of EIA

report/documents available to the public, subject to payment by the interested parties of full costs of printing.

6. OTHER PROCEDURAL REQUIREMENTS

- 6.1 If there is any change in the name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.
- 6.2 If there is any key change in the scope of the Project mentioned in Section 1.2 of this EIA study brief and in Project Profile (No. PP-437/2011), the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes, and the additional issues, if any, that the EIA study must also address. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

May 2011
Environmental Assessment Division
Environmental Protection Department

Appendix A**Requirements for Air Quality Impact Assessment**

The air quality impact assessment shall include the following:

1. Background and Analysis of Activities
 - (i) Provision of background information relating to air quality relevant to the Project, e.g. description of the types of activities of the Project that may affect air quality during construction stage of the Project.
 - (ii) Giving an account, where appropriate, of the consideration/measures that had been taken into consideration in the planning of the Project to abate air quality impacts.
2. Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/Dispersion Characteristics
 - (i) Identification and description of existing, planned and committed ASRs that would likely be affected by the Project, including those earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board. The Applicant shall select the assessment points of the identified ASRs that represent the worst impact point of these ASRs. A map clearly showing the location and description such as name of buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources shall also be given.
 - (ii) Provision of a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact related to the Project based on the analysis of the activities during construction stage of the Project in Section 1. Confirmation regarding the validity of the assumptions adopted and the magnitude of the activities (e.g. volume of construction material handled, volume of dredging material handled, etc.) shall be obtained from the relevant government departments / authorities and documented.
 - (iii) The emissions from any concurrent projects identified as relevant during the course of the EIA study shall be taken into account as contributing towards the overall cumulative air quality impacts. The impact at the existing, committed and planned ASRs within the assessment area shall be assessed, based on the best information available at the time of assessment.
3. Construction Phase Air Quality Impact
 - (i) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that construction dust impacts are controlled within the relevant standards as stipulated in Section 1

of Annex 4 of the TM. A monitoring and audit programme for the construction phase shall be devised to verify the effectiveness of the control measures proposed so as to ensure proper construction dust control.

- (ii) If the Applicant anticipates that the Project will give rise to significant construction dust impacts likely to exceed recommended limits in the TM at the ASRs despite the incorporation of the dust control measures proposed, a quantitative assessment should be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in Sections 5-7 below when carrying out the quantitative assessment.

4. Operational Phase Air Quality Impact

Not used

5. Quantitative Assessment Methodology

- (i) The Applicant shall apply the general principles enunciated in the modeling guidelines in Appendices A1 to A3 while making allowance for the specific characteristic of the Project. The Applicant must ensure consistency between the text description and the model files at every stage of submissions for review. In case of doubt, prior agreement between the Applicant and the Director on the specific modelling details should be sought.
- (ii) The Applicant shall identify the key/representative air pollution parameters (types of pollutants and averaging time concentrations) to be evaluated and provide explanation for selecting such parameters for assessing the impact from the Project.
- (iii) The Applicant shall calculate the overall cumulative air quality impact at the ASRs identified under Section 2 above and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted air quality impacts (both unmitigated and mitigated) shall be presented in the form of summary table(s) and pollution contours, to be evaluated against the relevant air quality standards and on any effect they may have on the land use implications. Plans of a suitable scale should be used to present pollution contours to allow buffer distance requirements to be determined properly.

6. Mitigation Measures for Non-compliance

The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set in Section 1 of Annex 4 in the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments/authorities and documented. The Applicant shall demonstrate quantitatively whether the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in Section 1 of Annex 4 in the TM.

7. Submission of Model Files

All input and output file(s) of the model run(s) shall be submitted to the Director in electronic format together with the submission of the EIA report.

Appendix A-1**Guidelines on Choice of Models and Model Parameters**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

- 1.1 To expedite the review process by the Authority and to assist project proponents or environmental consultants with the conduct of air quality modelling exercise which are frequently called for as part of environmental impact assessment studies, this paper describes the usage and requirements of a few commonly used air quality models.

2. Choice of Models

- 2.1 The models which have been most commonly used in air quality impact assessments, due partly to their ease of use and partly to the quick turn-around time for results, are of Gaussian type and designed for use in simple terrain under uniform wind flow. There are circumstances when these models are not suitable for ambient concentration estimates and other types of models such as physical, numerical or mesoscale models will have to be used. In situations where topographic, terrain or obstruction effects are minimal between source and receptor, the following Gaussian models can be used to estimate the near-field impacts of a number of source types including dust, traffic and industrial emissions.

Model Applications

FDM	for evaluating fugitive and open dust source impacts (point, line and area sources)
CALINE4	for evaluating mobile traffic emission impacts (line sources)
ISCST3	for evaluating industrial chimney releases as well as area and volumetric sources (point, area and volume sources); line sources can be approximated by a number of volume sources.

These frequently used models are also referred to as Schedule 1 models (see attached list).

- 2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix A-3.
- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements**3.1 Meteorological Data**

- 3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest

short-term (hourly, daily) and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

- 3.1.2 Alternatively, the meteorological conditions as listed below can be used to examine the worst case short-term impacts:

Day time: stability class D; wind speed 1 m/s (at 10m height); worst-case wind angle; mixing height 500 m

Night time: stability class F; wind speed 1 m/s (at 10m height); worst case wind angle; mixing height 500 m

This is a common practice with using the CALINE4 model due to its inability to handle lengthy data set.

- 3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:

- (i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10°) and stability (classes A to F) combinations and their frequency of occurrence;
- (ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
- (iii) apply the frequency data with the short term results to determine the long term (daily /annual) impacts.

Apart from the above, any alternative approach that will capture the worst possible impact values (both short term and long term) may also be considered.

- 3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.

- 3.1.5 An additional parameter, namely, the standard deviation of wind direction, σ_{θ} , needs to be provided as input to the CALINE4 model. Typical values of σ_{θ} range from 12° for rural areas to 24° for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18° is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

Ref.(1): Guideline On Air Quality Models (Revised), EPA-450/2-78-027R, United States Environmental Protection Agency, July 1986.

3.2 Emission Sources

All the identified sources relevant to a process plant or a study site should be entered in the model and the emission estimated based on emission factors compiled in the AP-42 (Ref. 2) or other suitable references. The relevant sections of AP-42 and any parameters or assumptions used in deriving the emission rates (in units g/s, g/s/m or g/s/m²) as required by

the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

If the emission of a source varies with wind speed, the wind speed-dependent factor should be entered.

Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, United States Environmental Protection Agency, January 1995.

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are classed as either rural or urban so as to reflect the enhanced mixing that occurs over urban areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classed as rural.

3.4 Surface Roughness Height

This parameter is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

3.5 Receptors

These include discrete receptors representing all the identified air sensitive receivers at their appropriate locations and elevations and any other discrete or grid receptors for supplementary information. A receptor grid, whether Cartesian or Polar, may be used to generate results for contour outputs.

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP ($< 30 \mu\text{m}$) and RSP ($< 10 \mu\text{m}$) compositions should be used.

3.7 NO₂ to NO_x Ratio

The conversion of NO_x to NO₂ is a result of a series of complex photochemical reactions and has implications on the prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO₂:

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO₂; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO₂ emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 $\mu\text{g}/\text{m}^3$ depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix A-2).

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

<u>Stability Category</u>	<u>1-hour to 5-sec Conversion Factor</u>
A & B	45
C	27
D	9
E & F	8

Under 'D' class stability, the 5-second concentration is approximately 10 times the hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odor Regulations, Controls and Technology, Air & Waste Management Association, 1991.

Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

The ISCST3 model provides by default a list of the U.S. regulatory options for concentration calculations. These are all applicable to the Hong Kong situations except for the 'Final Plume Rise' option. As the distance between sources and receptors are generally fairly close, the non-regulatory option of 'Gradual Plume Rise' should be used instead to give more accurate estimate of near-field impacts due to plume emission. However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with EPD. The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix A-3.

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.

Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207,

Tokyo, 1977.

3.11 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix A-2 for further information.

3.12 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area.

Copies of model files in electronic format should also be provided for EPD's reference.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998*

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix A-2**Guidelines on Assessing the 'TOTAL' Air Quality Impacts**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Total Impacts - 3 Major Contributions

- 1.1 In evaluating the air quality impacts of a proposed project upon air sensitive receivers, contributions from three classes of emission sources depending on their distance from the site should be considered. These are:

Primary contributions:	project induced
Secondary contributions:	pollutant-emitting activities in the immediate neighbourhood
Other contributions: (Background contributions)	pollution not accounted for by the previous two

2. Nature of Emissions**2.1 Primary contributions**

In most cases, the project-induced emissions are fairly well defined and quite often (but not necessarily) the major contributor to local air quality impacts. Examples include those due to traffic network, building or road construction projects.

2.2 Secondary contributions

Within the immediate neighbourhood of the project site, there are usually pollutant emitting activities contributing further to local air quality impacts. For most local scale projects, any emission sources in an area within 500m radius of the project site with notable impacts should be identified and included in an air quality assessment to cover the short-range contributions. In the exceptional cases where there is one or more significant sources nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach**3.1 The approach**

In view of the difficulties in estimating background air quality using the air quality models currently available, an alternative approach based on monitored data is suggested. The

essence of this approach is to adopt the long-term (5-year) averages of the most recent monitored air quality data obtained by EPD. These background data would be reviewed yearly or biennially depending on the availability of the monitored data. The approach is a first attempt to provide a reasonable estimate of the background air quality level for use in conjunction with EIA air quality assessment to address the cumulative impacts upon a locality. This approach may be replaced or supplemented by superior modelling efforts such as that entailed in PATH (Pollutants in the Atmosphere and their Transport over Hong Kong), a comprehensive territory-wide air quality modelling system currently being developed for Hong Kong. Notwithstanding this, the present approach is based on measured data and their long term regional averages; the background values so derived should therefore be indicative of the present background air quality. In the absence of any other meaningful way to estimate a background air quality for the future, this present background estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

The monitored air quality data, by 'district-averaging' are further divided into three categories, viz, Urban, Industrial and Rural/New Development. The background pollutant concentrations to be adopted for a project site would depend on the geographical constituency to which the site belongs. The categorization of these constituencies is given in Section 3.4. The monitoring stations suggested for the 'district-averaging'(arithmetic means) to derive averages for the three background air quality categories are listed as follows:

Urban: Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western
 Industrial: Kwun Tong, Tsuen Wan and Kwai Chung
 Rural/New Development: Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

The averaging would make use of data from the above stations wherever available. The majority of the monitoring stations are located some 20m above ground.

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been obtained for a few major air pollutants as follows:

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO ₂	59	57	39
SO ₂	21	26	13
O ₃	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

In cases where suitable air quality monitoring data representative of the study site such as those obtained from a nearby monitoring station or on-site sampling are not available for the prescription of background air pollution levels, the above tabulated values can be adopted instead. Strictly speaking, the suggested values are only appropriate for long term assessment. However, as an interim measure and until a better approach is formulated, the same values can also be used for short term assessment. This implies that the short term background values will be somewhat under-estimated, which compensates for the fact that some of the

monitoring data are inherently influenced by secondary sources because of the monitoring station location.

Indeed, if good quality on-site sampling data which cover at least one year period are available, these can be used to derive both the long term (annual) and short term (daily / hourly) background values, the latter are usually applied on an hour to hour, day to day basis.

3.4 Site categories

The categories to which the 19 geographical constituencies belong are listed as follows:

DISTRICT	AIR QUALITY CATEGORY
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

$$(1.0 - E_{\text{Secondary contributions}}/E_{\text{Territory}})$$

where E stands for emission.

The significance of this factor is to eliminate the fractional contribution to background pollutant level of emissions due to 'secondary contributions' out of those from the entire territory. In most cases, this fractional contribution to background pollutant levels by the secondary contributions is minimal.

4. Conclusions

- 4.1 The above described approach to estimating the total air quality impacts of a proposed project, in particular the background pollutant concentrations for air quality assessment, should be adopted with immediate effect. Use of short term monitoring data to prescribe the background concentrations is no longer acceptable.

Appendix A-3**Guidelines on the Use of Alternative Computer Models
in Air Quality Assessment**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Background

- 1.1 In Hong Kong, a number of Gaussian plume models are commonly employed in regulatory applications such as application for specified process licences and environmental impact assessments (EIAs). These frequently used models (as listed in Schedule 1 attached; hereafter referred to as Schedule 1 models) have no regulatory status but form the basic set of tools for local-scale air quality assessment in Hong Kong.
- 1.2 However, no single model is sufficient to cover all situations encountered in regulatory applications. In order to ensure that the best model available is used for each regulatory application and that a model is not arbitrarily applied, the project proponent (and/or its environmental consultants) should assess the capabilities of various models available and adopt one that is most suitable for the project concerned.
- 1.3 Examples of situations where the use of an alternative model is warranted include:
- (i) the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and
 - (ii) the performance of an alternative model is comparable or better than the Schedule 1 models.
- 1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

- 2.1 Any model that is proposed for air quality applications and not listed amongst the Schedule 1 models will be considered by EPD on a case-by-case basis. In such cases, the proponent will have to provide the followings for EPD's review:
- (i) Technical details of the proposed model; and
 - (ii) Performance evaluation of the proposed model
- Based on the above information, EPD will determine the acceptability of the proposed model for a specific or general applications. The onus of providing adequate supporting materials rests entirely with the proponent.
- 2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:
- (i) mathematical formulation and data requirements of the model;
 - (ii) any previous performance evaluation of the model; and
 - (iii) a complete set of model input and output file(s) in commonly used electronic format.

- 2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.*
- 2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that
- (i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or
 - (ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- 2.5 Should EPD find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.
- 2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.
- 2.7 If EPD is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with EPD to avoid sending in duplicate information.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998*

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EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix B

NOT USED

Appendix C**Requirements for Noise Impact Assessment**

The noise impact assessment shall include the following:

1. **Provision of Background Information**
 - (i) The Applicant shall provide background information relevant to the Project, including relevant previous or current studies.
2. **Identification of Noise Sensitive Receivers:**
 - (i) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include existing NSRs and planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board. Photographs of existing NSRs shall be appended to the EIA report.
 - (ii) The Applicant shall select assessment points to represent the identified NSRs for carrying out quantitative noise assessment described below. A map showing the locations and descriptions such as name of building, use, and floor of the selected assessment points shall be given.
3. **Provision of an Emission Inventory of the Noise Sources:**
 - (i) The Applicant shall provide an inventory of noise sources including representative construction equipment for the purpose of carrying out the construction noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.
4. **Construction Noise Assessment:**
 - (i) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during daytime, i.e. 7am to 7pm, on weekdays other than general holidays in accordance with methodology in paragraphs 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of TM shall be adopted in the assessment.
 - (ii) To minimize the construction noise impact, alternative construction methods to replace percussive piling and blasting shall be proposed as far as practicable.
 - (iii) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, rescheduling and restricting hours of operation of noisy tasks) to minimize the

impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance at the affected NSRs shall be given.

- (iv) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to relevant technical memoranda issued under the NCO. In case the Applicant considers that there is an unavoidable need to conduct certain type of construction works during the restricted hours, justifications shall be provided with the assessment of the degree and duration of the noise impact. Regardless of the results of construction noise impact assessment for restricted hours, the Noise Control Authority will process Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect shall be explicitly stated in the EIA report.
- (v) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and other concurrent projects identified during the course of the EIA study.

5. Operation Noise Assessment of Fixed Noise Sources

Not used

6. Assessment of Side Effects and Constraints:

- (i) The Applicant shall identify, assess and propose means to minimize any side effects and to resolve any potential constraints due to the inclusion of any recommended direct mitigation measures.

7. Evaluation of Constraints on Planned Noise Sensitive Developments/Land uses

- (i) For planned noise sensitive uses which will still be affected even with practicable direct mitigation measures in place, the Applicant shall propose, evaluate and confirm the practicability of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of relevant parties.
- (ii) The Applicant shall take into account agreed environmental requirements/constraints identified by the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

Appendix D**Requirements for Water Quality Impact Assessment**

1. The Applicant shall identify and analyse physical, chemical and biological disruptions of inland water, drainage system and storm channel(s) arising from construction and operation of the Project.
2. The Applicant shall address (a) the construction impacts on water quality at the Project site; and (b) the operation phase impacts on water quality at downstream of the Project site, in particular the Ngong Ping stream due to the natural process of siltation, flows and water velocity, and maintenance works. The water quality impact assessment shall cover the following, but not limited to, major areas of concern:
 - (i) Collection and review of background information on the existing water system(s) and their respective catchments, and sensitive receivers which may be affected by the Project during construction and operational stage;
 - (ii) Characterization of water quality of the related water system(s) , their respective catchment and sensitive receivers, which may be affected by the Project during construction and operational stage, based on existing best available information or appropriate site survey/tests;
 - (iii) Identification and analysis of the existing and future activities and beneficial uses related to the water system(s) and identification of the water sensitive receivers;
 - (iv) Identification of pertinent water quality objectives and establishment of other appropriate water quality criteria and standards for the water system(s) and the sensitive receivers as mentioned in sub-section (i), (ii) and (iii) above, including ecological sensitive receivers for the assessment covered in section 3.4.7 of the Study Brief;
 - (v) Identification of any alteration of watercourses, natural streams, meanders, flow regimes, ground water levels and catchment types or areas;
 - (vi) Identification and quantification of likely future water pollution sources, including point discharges and non-point sources to surface water runoff;
 - (vii) Establishment and provision of an emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the study area. Field investigation and laboratory tests shall be conducted as appropriate to fill in any relevant information gaps;
 - (viii) Assess the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project;

- (ix) Assess and evaluate the impacts on the identified water system(s), respective catchments and sensitive receivers due to sewage arising from the construction stage. Any effluent generated will require appropriate collection, treatment and disposal to within standards and objectives and criteria established in (iv) above;
- (x) Assess and evaluate the potential stormwater and construction runoff impacts on the water system(s), respective catchments and sensitive receivers during construction stages and operational maintenance works (such as regular desilting and dredging) so as to reduce the water quality impacts to within standards, objectives and criteria established in (iv) above;
- (xi) Possible impacts include change in hydrology, flow regime and water quality. The prediction shall take into account and include likely different construction stages or sequences, different operational stages;
- (xii) Proposals for effective and practicable infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the construction and operational stages to reduce the water quality impacts to within acceptable levels of standards. Requirements to be incorporated in the Project contract document shall also be proposed.
- (xiii) Evaluate and quantify residual impacts on the affected water system(s) and the sensitive receivers with regard to the appropriate water quality criteria, standards or guidelines.

Appendix E**Requirements for Assessment of Waste Management Implication**

The assessment of waste management implication and land contamination shall cover the following:

1. Analysis of Activities and Waste Generation

- (i) The Applicant shall identify the quantity, quality and timing of the wastes arising as a result of the construction and operation activities of the Project based on the sequence, duration, method and process of these activities e.g. any construction and demolition materials and other wastes which will be generated during construction and operational stages. The Applicant shall adopt appropriate design, general layout, construction methods and programme to minimize the generation of public fill/inert construction and demolition (C&D) materials and maximize the use of public fill / inert C&D materials for other construction works.

2. Proposal for Waste Management

- (i) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures that can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered;
- (ii) After considering the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal methods/ options for each type of wastes shall be described in detail. The disposal methods/ options recommended for each type of wastes shall take into account the result of the assessment in Section 2 (iv) below;
- (iii) The EIA report shall state the transportation routings and the frequency of the trucks/ vessels involved, any barging point or conveyor system to be used, the stockpiling areas and the disposal outlets for the wastes identified; and
- (iv) The impact caused by handling (including stockpiling, labelling, packaging & storage), collection, transportation and re-use/ disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas:
 - potential hazard;
 - air and odour emissions;
 - noise;
 - wastewater discharge;
 - ecology; and
 - public transport.

3. Excavation, Filling and Dumping

- (i) Identification and quantification as far as practicable of all excavation, fill extraction, filling, sediment/mud transportation and disposal activities and requirements shall be conducted. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM) prior to the commencement of the tests and documented in the EIA report for consideration. The categories of sediment/mud which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any serious contamination of sediment/mud which requires special treatment/disposal is confirmed, the Applicant shall identify the most appropriate treatment and / or disposal arrangement and demonstrate its feasibility. The Applicant shall provide supporting document, such as agreement by the relevant facilities management authorities, to demonstrate the viability of any treatment/disposal plan;
- (ii) Identification and evaluation of the best practicable dredging/excavation methods, treatment methods, in-situ / ex-situ arrangements, reuse/ recycling options and construction programme to minimize dredging/excavation and dumping requirements and demand for fill sources based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as possible.

Appendix F**Requirements for Ecological Impact Assessment (Terrestrial and Aquatic)**

1. The Applicant shall examine the flora, fauna and other components of the ecological habitats within the assessment area. The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid or minimise impacts on conservation areas, sites of special scientific interest and other ecological sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impacts, both directly by physical disturbance and indirectly by changes of water quality and hydrodynamic regime to the natural environment and the associated wildlife groups and habitats / species arising from the Project including its construction phases as well as the subsequent management and maintenance of the proposals.
2. The assessment shall include the followings:
 - (i) Review of the findings of relevant studies / surveys and collection of the available information regarding the ecological characters of the assessment area;
 - (ii) Evaluation of information collected and identification of any information gap relating to the assessment of potential ecological impact;
 - (iii) Carrying out necessary field surveys (the duration of which shall be at least 6 months covering wet and dry seasons) and investigations to verify the information collected in (ii) above, to fill the information gaps identified and to fulfill the objectives of the EIA study. The field surveys shall include but not be limited to flora, fauna and any other habitats/species of conservation importance;
 - (iv) Establishment of the general ecological profile of the Study Area based on data of relevant previous studies / surveys and results of the ecological field surveys, and description of the characteristics of each habitat found; major information to be provided shall include :
 - (a) description of the physical environment, including all recognized sites of conservation importance, and assessment of whether these sites will be affected by the Project or not;
 - (b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats and species of conservation interest in the assessment area;
 - (c) ecological characteristics of each habitat type such as extent, substrate, size, type, species present, dominant species found, species diversity and abundance, community structure, ecological value and inter-dependence of the habitats and species, and presence of any features of ecological importance;
 - (d) representative colour photos of each habitat type and any important

- ecological features identified; and
- (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or red data books.
- (v) Investigation and description of the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including
- (a) natural stream courses, rivers and associated riparian habitats; and
 - (b) woodlands;
 - (c) vertebrates (e.g. avifauna, mammals, fish and herpetofauna);
 - (d) macroinvertebrates (e.g. butterflies, odonates and crustaceans); and
 - (e) any other habitats/species identified as having special conservation interest by this EIA study.
- (vi) Using suitable methodology and considering also other works activities from other projects reasonably likely to occur at the same time, identification and quantification as far as possible of any direct (e.g. loss of habitats due to various elements such as excavation works and other associated works of the Project), indirect (e.g. changes in water qualities, hydrodynamics properties, hydrology, accidental discharge of untreated sewage, noise and other disturbance generated by the construction and operational activities etc), on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance / diversity, loss of feeding and breeding grounds, reduction of ecological carrying capacity, habitat fragmentation, and in particular the followings:
- (a) Potential destruction or disturbance to ecological habitats in the Conservation Areas, Site of Special Scientific Interest and Lantau North Country Park;
 - (b) Disturbance to animals and plants (e.g. potential damage on tree roots by construction activities);
 - (c) Impacts due to potential changes in water quality, hydrodynamics properties in natural stream courses, rivers and associated riparian habitats; and
 - (d) Potential impacts to any others habitats / species of conservation value discovered during the course of the EIA study;
- (vii) Evaluation of ecological impact based on the best and latest information available during the course of the EIA study, using quantitative approach as far as practicable and covering construction and operational phases of the Project as well as the subsequent management and maintenance requirement of the Project. Potential cumulative ecological impact on habitats and species of conservation interest arising from the Project and interacting projects as

identified in the EIA study shall be evaluated;

- (viii) Recommendations for possible alternatives, such as layer, design and alignment of the Project and modification / change of construction methods, and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified during construction and operation of the Project;
- (ix) Evaluation of the feasibility and effectiveness of the recommended mitigation measures and definition of the scope, type, location, implementation arrangement, resources requirement, subsequent management and maintenance of such measures;
- (x) Review whether there is any potential impact on environmental mitigation measures proposed under the Tung Chung Cable Car Project - Diversion of the Ngong Ping Stream as detailed in the Project Profile (Register No. PP-193/2003) and the environmental permit (Register No. EP-192/2004);
- (xi) Determination and quantification as far as possible of the residual ecological impacts after implementation of the proposed mitigation measures;
- (xii) Evaluation of the significance and acceptability of the residual ecological impacts by making reference to the criteria in Annex 8 of the TM; and
- (xiii) Review of the need for and recommendation on any ecological monitoring programme required.

NOT USED

Appendix G

Appendix H**Requirements for Landscape and Visual Impact Assessments**

1. The Applicant shall review relevant plan(s) and/or studies which may identify areas of high landscape value and recommend country park, coastal protection area, green belt and conservation area designations. Any guidelines on landscape and urban design strategies and frameworks that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future outlook of the area affected so as to assess whether the Project can fit into the surrounding setting. Any conflict with the statutory town plan(s) and any published land use plans shall be highlighted and appropriate follow-up action shall be recommended.
2. The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the assessment area. A system shall be derived for judging landscape and visual impact significance. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgment from a landscape and visual point of view. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape setting, recreation and tourism related uses, and scenic spot. The landscape impact assessment shall quantify the potential landscape impact as far as possible so as to illustrate the significance of such impacts arising from the proposed development. Clear mapping of the landscape impact is required. Where applicable, tree survey shall be carried out and the impacts on existing trees shall be addressed. Cumulative landscape and visual impacts of the Project with other committed and planned developments shall be assessed.
3. The Applicant shall assess the visual impacts of the Project. Clear illustration including mapping of visual impact is required. The assessment shall include the following:
 - (i) identification and plotting of visual envelope of the Project;
 - (ii) identification of the key groups of existing and planned sensitive receivers including, but not limited to, tourists, hikers, workers and residents in the vicinity of the project within the visual envelope with regard to views from ground level and elevated vantage points;
 - (iii) description of the visual compatibility of the Project with the surrounding and the planned setting, and its obstruction and interference with the key views within the visual envelope;
 - (iv) identification of the severity of visual impacts in terms of distance, nature and number of sensitive receivers. The visual impacts of the Project with and without mitigation measures shall be included and illustrated so as to demonstrate the effectiveness of the proposed mitigation measures across time; and

-
- (v) evaluations and explanations of the factors considered in arriving the significance thresholds of visual impact.
4. The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area if it will be affected by the Project. In addition, alternative site layout, design and construction method that will avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize adverse effects identified above, including provision of a master landscape plan.
 5. The mitigation measures shall also include design of structure, conservation of topsoil or rock for use, colour scheme and texture of material used and any measures to mitigate the impact on the existing and planned land use and visually sensitive receivers. Parties shall be identified for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the construction phase and operational phase of the Project, associated works, supporting facilities and essential infrastructures. A practical programme and funding proposal for the implementation of the recommendation measures shall be provided.
 6. Annotated illustration materials such as colour perspective drawings, plans and section/elevation diagrams, annotated oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontage shall be adopted to fully illustrate the landscape and visual impacts of the Project. In particular, the landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. Computer graphics shall be compatible with Microstation DGN file format. The Applicant shall record the technical details in preparing the illustration, which may need to be submitted for verification of the accuracy of the illustration.

Appendix I**Requirements for Built Heritage Impact Assessment and Archaeological Impact Assessment under Cultural Heritage Impact Assessment**

1. Built Heritage Impact Assessment (BHIA) – The applicant shall conduct a BHIA, taking the result of previous BHIA and other background of the site into account, to identify known and unknown built heritage items within the assessment area that may be affected by the Project and its associated works to assess the direct and indirect impacts on the built heritage items. The impacts include visual impact, impacts on the fung shui/visual corridor of the historic buildings and structures through change of water-table, vibration caused by the Project. Assessment of impacts on cultural heritage shall also take full account of, and allow where appropriate, the Guidelines for Landscape and Visual Impact Assessment of Annex 18 of the TM. The Applicant shall draw necessary reference to relevant sections of the Guidelines for Culture Heritage Impact Assessment in Appendix I-2 of this study brief.
2. Archaeological Impact Assessment (AIA) - The Applicant shall engage qualified archaeologist(s) to review the archaeological potential of the Project sites taking the results of previous studies and other background of the sites into account. In case the existing information is inadequate or where the Project sites have not been adequately studied before, the archaeologist(s) shall conduct archaeological investigations to assemble data. The archaeologist(s) shall obtain licence(s) from the Antiquities Authority prior to commencement of archaeological field investigations. Details of the archaeological impact assessment shall be submitted to the Antiquities and Monuments Office and the Director prior to the commencement of the assessment for consideration. The Applicant shall draw necessary reference to relevant sections of the Guidelines for Cultural Heritage Impact Assessment at Appendix I-2.
3. The Applicant shall demonstrate that the disturbances to those sites of cultural heritage are avoided to the maximum practicable extent by modification of the design of the Project. For those identified sites of cultural heritage that may still be directly and indirectly affected by the Project, the Applicant shall recommend practicable mitigation measures and monitoring to avoid or minimise the adverse impacts on the sites of cultural heritage. A checklist including the affected sites of cultural heritage, identified impacts, recommended mitigation measures as well as the implementation agent and period shall be given in the EIA report.

NOT USED

Appendix I-1

Appendix I-2**Guidelines for Cultural Heritage Impact Assessment**

(as at April 2011)

Introduction

The purpose of the guidelines is to assist the understanding of the requirements in assessing impact on archaeological and built heritage. The guidelines which will be revised by the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.

A comprehensive Cultural Heritage Impact Assessment (CHIA) includes a baseline study, an impact assessment study associated with the appropriate mitigation measures proposed and to be implemented by project proponents.

(1) Baseline Study

1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of heritage sites within the proposed project area, which include:
 - (i) all sites of archaeological interest (both terrestrial and marine);
 - (ii) all pre-1950 buildings and structures;
 - (iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and
 - (iv) cultural landscapes include places associated with historic event, activity, or person or exhibiting other cultural or aesthetic values, such as sacred religious sites, battlefields, a setting for buildings or structures of architectural or archaeological importance, historic field patterns, clan graves, old tracks, *fung shui* woodlands and ponds, and etc.
- b. to identify the direct and indirect impacts on the heritage sites at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact on its settings

or impinging on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, ecological damage, new recreation or other daily needs to be caused by the new development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

1.2 The baseline study shall also include a desk-top research and a field evaluation.

1.3. Desk-top Research

1.3.1 Desk-top research should be conducted to analyse, collect and collate the best available information. It shall include (if applicable) but not limited to:

- a. List of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
- b. Graded historic buildings and sites.
- c. Government historic sites identified by AMO.
- d. Lists and archives kept in the Reference Library of AMO including sites of archaeological interest, declared monuments, proposed monuments, deemed monuments and recorded historical building & structures identified by AMO.
- e. Publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological Society, AMO Monograph Series and so forth.
- f. Other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.
- g. Any other unpublished archaeological investigation and excavation reports kept by AMO.
- h. Relevant information from AMO's website.
- i. Historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.
- j. Cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Map and Aerial Photo Library of the Lands

Department.

- k. Existing geological and topographic information (for archaeological desk-top research).
- l. Discussion with local informants.

1.4 Field Evaluation

1.4.1 General

The potential value of the project area with regard the cultural heritage could be established easily where the area is well-documented. However, it does not mean that the area is devoid of interest if it lacks information. In these instances, site inspections and consultations with appropriate individuals or organisations should be conducted by those with expertise in local heritage to clarify the situation.

1.4.2 Field survey on historic buildings and structures

- a. Field scan of all the historic buildings and structures within the project area.
- b. Photographic recording of each historic building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up for the special architectural details) and the interior (special architectural details), if possible, as well as the surroundings, the associated cultural landscape features and the associated intangible cultural heritage (if any) of each historic building or structure.
- c. Interview with local elders and other informants on local historical, architectural, anthropological and other cultural information related to the historic buildings and structures.
- d. Historical and architectural appraisal of the historic buildings and structures, their associated cultural landscape and intangible cultural elements.

1.4.3 Archaeological Survey

- a. Appropriate methods for pricing and valuation of the archaeological survey, including by means of a Bill of Quantities or a Schedule of Rates should be adopted when appropriate in preparing specifications and relevant documents for calling tenders to carry out the archaeological survey. The specifications and relevant documents should be sent to AMO for agreement prior to calling tenders to conduct the archaeological survey.

-
- b. For archaeologists involved in contract archaeological works, they should adhere to recognized standards for professional practice and ethical conduct in undertaking commissioned archaeological works under contracts. They should make themselves fully understand recognized principles and guidelines regarding contract archaeological works, such as those of the Institute for Archaeologists, European Associations of Archaeologists and in Mainland China.
 - c. A licence shall be obtained from the Antiquities Authority for conducting archaeological field work. It takes at least two months to process an application.
 - d. An archaeological brief/proposal, as an outline framework of the proposed archaeological works, should be prepared. The brief/proposal should clearly state the project and archaeological background, address necessary archaeological works required, elaborate the strategy and methodology adopted, including what particular research question(s) will be resolved, how the archaeological data will be collected and recorded, how the evidence will be analysed and interpreted and how the archaeological finds and results will be organized and made available. Effective field techniques including method and sampling details are required to be demonstrated clearly in the brief/proposal. Monitoring arrangement, reporting, contingency plan for field and post-excavation works and archive deposition (including finds, field and laboratory records, etc.) should also be addressed in the brief/proposal. The brief/proposal should be submitted to AMO for agreement prior to applying for a licence. Prior site visit to the project site before the submission of the brief/proposal is required so as to ascertain the feasibility of the proposed strategy and methodology as well as the availability of the proposed locations for auger survey and test pitting.
 - e. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:
 - (i) Definition of areas of natural land undisturbed in the recent past.
 - (ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.
 - (iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the

horizontal spread of cultural materials deposits.

- (iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.
- (v) The quantity and location of auger holes and test pits should be agreed with AMO prior to applying for a licence. Additional auger holes and test pits may be required to ascertain and demarcate the extent of archaeological deposits and remains.
- (vi) A qualified land surveyor should be engaged to record reduced levels and coordinates as well as set base points and reference lines in the course of the field survey.
- (vii) All archaeological works should be properly completed and recorded to agreed standards.

f. Archaeologists should adhere to all the agreed professional and ethical standards for archaeological works, such as the standards and guidelines of the Institute for Archaeologists, English Heritage, European Associations of Archaeologists, Society for American Archaeology and in Mainland China.

g. A Marine Archaeological Investigation (MAI) following *Guidelines for MAI* may be required for projects involving disturbance of seabed.

1.4.4 If the field evaluation identifies any additional heritage sites within the study area which are of potential historic or archaeological importance/interest and not recorded by AMO, the findings should be reported to AMO as soon as possible.

1.5 The Report of Baseline Study

1.5.1 The study report should unequivocally include all the direct and concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the heritage sites supported by full description of their significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other relevant data supplemented with illustrations below and photographic and cartographic records, if required.

1.5.2 A master layout plan showing all the identified archaeological and built heritage

within the study area should be provided in the report. All the identified heritage sites should be properly numbered with their locations indicated on the master layout plan.

1.5.3 Historic Buildings/ Structures/ Sites

- a. A map in 1:1000 scale showing the boundary of each historic item.
- b. Photographic records of each historic item.
- c. Detailed recording form of each historic item including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, cultural landscape features and cultural activities associated with the structure.
- d. A cross-referenced checklist including the reference number of each historical item, their photo and drawing reference, as well as the page number of the detailed recording form of each identified historical item for easy cross-checking of individual records.

1.5.4 Sites of Archaeological Interest

- a. A map showing the boundary of each site of archaeological interest as supported and delineated by field walking, augering and test-pitting.
- b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
- c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified land surveyor.
- d. *Guidelines for Archaeological Reports* should be followed (Annex 1).

1.5.5 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence, including the title of the relevant material, its author(s), publisher, publication place and date. To facilitate verification of the accuracy, AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

1.6 Finds and Archives

1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives* (Annex 2).

1.7 Safety Issue

- 1.7.1 During the course of the CHIA Study, all participants shall comply with all Ordinances, Regulations and By-laws which may be relevant or applicable in safety aspect in connection with the carrying out of the CHIA Study, such as site safety, insurance for personal injuries, death and property damage as well as personal safety apparatuses, etc.
- 1.7.2 A Risk Assessment for the fieldwork shall be carried out with full consideration to all relevant Ordinances, Regulations and By-laws.

1.8 Information Disclosure

- 1.8.1 For releasing any information on the CHIA Study, the archaeologist/expert involved should strictly comply with the terms and conditions set in the contract/agreement and avoid conflict of interest.

(2) Impact Assessment Study

2.1 Identification of impact on heritage

- 2.1.1 The impact assessment study must be undertaken to identify the impacts on the heritage sites which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by expert(s) in local heritage.
- 2.1.2 During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts should be clearly stated, such as adverse visual impact on heritage sites, landscape change to the associated cultural landscape features of the heritage sites, temporary change of access to the heritage sites during the work period, change of ground level or water level which may affect the preservation of the archaeological and built heritage *in situ* during the implementation stage of the project.
- 2.1.3 The evaluation of cultural heritage impact assessment may be classified into five levels of significance based on type and extent of the effects concluded in the CHIA study:

- a. Beneficial impact: the impact is beneficial if the project will enhance the preservation of the heritage site(s) such as improving the flooding problem of the historic building after the sewerage project of the area;
 - b. Acceptable impact: if the assessment indicates that there will be no significant effects on the heritage site(s);
 - c. Acceptable impact with mitigation measures: if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures, such as conduct a follow-up Conservation Proposal or Conservation Management Plan for the affected heritage site(s) before commencement of work in order to avoid any inappropriate and unnecessary interventions to the building;
 - d. Unacceptable impact: if the adverse effects are considered to be too excessive and are unable to mitigate practically;
 - e. Undetermined impact: if the significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.
- 2.1.4 Preservation in totality must be taken as the first priority as it will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the heritage site into the proposed project are carried out.
- 2.1.5 If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs which confirm the impracticability of total preservation.
- 2.1.6 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving local heritage as against that of the community as a whole. Assessment of impacts on heritage sites shall also take full account of, and follow where appropriate, paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process.

2.2 Mitigation Measures

- 2.2.1 It is always a good practice to recognize the heritage site early in the planning stage and site selection process, and to avoid it, i.e. preserve it *in-situ*, or leaving

a buffer zone around the site with full justifications demonstrating the best practice of heritage conservation.

- 2.2.2 Mitigation is not only concerned with minimizing adverse impact on the heritage site but also should give consideration of potential enhancement if possible (such as to improve the access to the heritage site or enhance the landscape and visual quality of the heritage site).
- 2.2.3 Mitigation measures shall not be recommended or taken as *de facto* means to avoid preservation of heritage sites. They must be proved beyond all possibilities to be the only practical course of action. Heritage sites are to be in favour of preservation unless it can be demonstrated that there is a need for a particular development which is of paramount importance and outweighs the significance of a heritage site.
- 2.2.4 If avoidance of the heritage site is not possible, amelioration can be achieved by minimizing the potential impacts and the preservation of the heritage site, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the heritage site and affects the character and integrity of the heritage site.
- 2.2.5 A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of site of archaeological interest “by record”, i.e. through excavation to extract the maximum data as the very last resort.

2.3 The Impact Assessment Report

- 2.3.1 A detailed description and plans should be provided to elaborate on the heritage site(s) to be affected. Besides, please also refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum, other appropriate presentation methods for mitigation proposals like elevations, landscape plan and photomontage shall be used in the report extensively for illustrating the effectiveness of the measures.
- 2.3.2 To illustrate the landscape and visual impacts on heritage sites, as well as effects of the mitigation measures, choice of appropriate presentation methods is

important. These methods include perspective drawings, plans and section/elevation diagrams, photographs on scaled physical models, photo-retouching and photomontage. These methods shall be used extensively to facilitate communication among the concerned parties.

- 2.3.3 The implementation programme for the agreed mitigation measures should be able to be executed and should be clearly set out in the report together with the funding proposal. These shall form an integral part of the overall redevelopment project programme and financing of the proposed redevelopment project. Competent professionals must be engaged to design and carry out the mitigation measures.
- 2.3.4 For contents of the implementation programme, reference can be made to Annex 20 of the Technical Memorandum on Environmental Impact Assessment Process. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the preserved heritage site, if any, during the planning and design stage of the proposed project must be addressed in details.
- 2.3.5 Supplementary information to facilitate the verification of the findings shall be provided in the report including but not limited to:
- a. layout plan(s) in a proper scale illustrating the location of all heritage sites within the study area, the extent of the work area together with brief description of the proposed works;
 - b. all the heritage sites within the study area should be properly numbered, cross-reference to the relevant drawings and plans.
 - c. an impact assessment cross-referenced checklist of all the heritage sites within the study area including heritage site reference, distance between the heritage site and work area, summary of the possible impact(s), impact level, summary of the proposed mitigation measure(s), as well as references of the relevant plans, drawings and photos; and
 - d. a full implementation programme of the mitigation measures for all affected heritage sites to be implemented with details, such as by whom, when, where, to what requirements and the various implementation responsibilities of individual parties.

** This Guidelines for Cultural Heritage Impact Assessment was first set out in August 2008 based on the Criteria for Cultural Heritage Impact Assessment and revised subsequently in December 2008, July 2010, October 2010, March 2011 and April 2011.*

Annex 1 to Appendix I-2**Guidelines for Archaeological Reports**

(As at April 2011)

I. General

1. All reports should be written in a clear, concise and logical style.
2. All the constituent parts (text, figures, photos and specialist reports (if any)) should provide full cross-reference. Readers should be able to find their way around the report without difficulty.
3. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
4. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
5. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
6. At least 5 hard copies of the final reports should be submitted to AMO for record purpose.
7. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.
8. Errors are the responsibilities of the author(s) and should so far as possible be identified and rectified before submission to AMO.
9. The guidelines which will be revised by the AMO of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.

II. Suggested Format of Reports

1. Front page:
 - Project/Site name
 - Nature of the report
 - e.g. (Draft/Final)
 - Archaeological Investigation/Survey Report
 - Archaeological Impact Assessment Report
 - Watching Brief Report
 - Rescue Excavation Report
 - Post-excavation Report
 - Organization
 - Date of report
2. Contents list
 - Page number of each section should be given.

3. Non-technical summary (both in English and Chinese with approximate 150 - 300 words each)
This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.
4. Introduction
This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be given. The location of archaeological work should be shown on maps in appropriate scales and with proper legends.
5. Aims of archaeological work
These should reflect the aims set in the project design.
6. Archaeological, historical, geological and topographical background of the site
Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.
7. Methodology
The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.
8. Results
 - The results should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. If more than one interpretation is possible, the alternatives should also be presented, at least in summary.
 - The results should be amplified by the use of drawings and photographs.
 - Tables summarizing features and artifacts by trench/grid/test pit together with their interpretation should be included.
 - The method, sampling details, results and interpretation as well as appropriate supporting data of the analysis for the environmental materials, e.g. ecofacts identified and/or collected during the fieldwork should be included.
 - For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.
9. Conclusion
This should include summarization and interpretation of the result.
10. Recommendation
Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.
11. Reference and bibliography
A list of all primary and secondary sources including electronic sources used should be given in full detail, including the title of the relevant material, its

author(s), publisher, publication place and date.

12. Archaeological team
The director and members of the archaeological team and the author(s) of the report should be clearly specified.
13. Copyright and dissemination
The copyright of the report should be clearly identified. To facilitate future research studies, please specify that the report can be made available to the public in the Reference Library of the Heritage Discovery Centre.
14. Supporting illustrations
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.
 - A. Maps
A location plan of the project site should be included. Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified land surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.
 - B. Drawings of test pits, archaeological features, special finds¹, selected representative samples from general finds
Drawings of all excavated test pits (at least one cross section of each test pit), all excavated archaeological features (both plan and cross section of each archaeological feature), all special finds identified in the excavation and selected representative samples from general finds (at least front view and section of each finds) should be included. All drawings should be clearly numbered and easily referenced to the text. The drawing scales stipulated below should be followed:

Cross section and profile drawings of test pits	1:20
Archaeological feature drawings	1:10
Finds drawings	1:1
 - C. Photos of project site and the surrounding area, test pits, archaeological features, special finds, selected representative samples from general finds
Photos of project site and the surrounding area, all excavated test pits (at least one cross section of each test pit), all excavated archaeological features (both plan and cross section of each archaeological feature), all

¹ Special finds are sometimes known as small finds (小物件) in Chinese or registered finds. Drawings and photos of the special/small/registered finds should be included in the archaeological report.

special finds identified in the excavation and selected representative samples from general finds (at least front view of each of the finds) should be included. All photos should be at least in 3R size with proper captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

15. Supporting data in appendices
These should consist of essential technical details to support the result. These may include stratigraphic record of test pits and auger holes, records of general and special finds as well as ecofacts discovered with description, quantity and context number/stratigraphic sequence, result of laboratory testing, index of field archives.
16. Other professional views/comments
This can reflect any issues/difficulties regarding the archaeological project observed/encountered by the archaeological team.
17. Comment and response
All comments and responses from AMO and relevant parties should be attached in full.

III. Green Measures

1. All reports should be of single line spacing and printed on both sides of the paper.
2. Excessive page margins should be avoided. A top/bottom margin of 2 cm and left/right margin of 2.5 cm are sufficient.
3. Use of blank paper should be avoided as far as possible.
4. Suitable font type of font size 12 should be used generally in balancing legibility and waste reduction objective.

Annex 2 to Appendix I-2**Guidelines on Handling of Archaeological Finds and Archives**

(As at April 2011)

I. General Remark

1. The guidelines which will be revised by the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.
2. Please use the site code (_____)** for the archaeological project, namely _____. Licensee must use this unique site code for the whole project.

** If an archaeological project covers more than one archaeological site/location, licensee should contact the Central Archaeological Repository (CAR) at 2384 5446 or aciamoar@lcsd.gov.hk to obtain relevant site codes.

3. Licensee should contact the CAR at 2384 5446 or aciamoar@lcsd.gov.hk regarding the handover of archaeological finds and archives when post-excavation research and excavation report have been completed and accepted by the AMO.
4. For the preparation of archaeological finds and archives for long-term curation by the CAR, the guidelines as set out below should be followed.
5. If the licensee does not handle the finds and archives in accordance with this guidelines, the AMO may inform the project proponent to revise the relevant data. The arrangement of handover may subsequently be deferred.

II. Archaeological Finds

6. **Cleaning**
The excavated finds should be properly cleaned with water, except: (i) the finds are identified for scientific analysis; (ii) metal & organic objects (e.g. bone, wood, leather, textile objects and etc.) should not be cleaned with water. Licensee is advised to consult the AMO if in doubt.
7. **Marking**
 - The excavated finds should be cleaned before marking object number.
 - “Sandwich” technique¹ should be adopted for marking permanent object

¹ *Steps for “Sandwich” technique*

1. First of all, the find number should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the find.
2. Clean the area to be marked.

number.

- Each special find should be marked with site code, context number and SF number, etc.
- Any representative samples selected from the general finds for discussion on the excavation report should be marked with site code, context number, sample number and bagged separately.
- The general finds should be marked with site code and context number.
- For the finds which are too small, organic objects (e.g. bone, wood, leather, textile objects and etc.) or have unstable surface, object number should not be marked on the object directly. These finds should be bagged separately and attached with a label containing information about the site code, context number, find number and description of find.

8. Labeling and bagging

- Two labels should be provided for each bag which contains finds, one is adhered on the surface of the bag while the other is kept inside the bag for easy reference.
- The label inside the bag should be kept separately with a smaller plastic bag so that the label can be kept much longer.
- Information about the site code, context number, test-pit number, object number (or bag number) and description of finds should be written clearly on the label.
- Finds under the same context should be bagged together. If those finds, however, have been categorized according to their typology, materials or characteristics, separate bagging is required.

9. Conservation

- To refit and reconstruct pottery vessels with appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
- Any adhesives which are not reversible or would damage the finds should not be applied on the finds. Archaeologist is advised to consult the AMO if in doubt.

10. Finds register

A standard finds register, for both special finds and general finds, with information about the find's number, name, description, quantity, type, weight, dimensions and field data should be duly filled in. Licensee should contact the CAR at 2384 5446 or aciamoar@lcsd.gov.hk to obtain the standard finds register (in Excel format). Special finds and general finds should be inputted in individual register. Both hard & soft copies (in Excel format) of the duly completed register should be handed over.

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3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
 4. Use a permanent water-based ink to write the find number on top of the base coat. Let ink dry completely.
 5. Apply a top coat of clear varnish.
 6. Let the marking dry completely before packing.

11. Sample register of eco-facts

A clear sample register with information about the description of the sample, quantity, type and weight should be prepared for handover.

III. Field Records and Finds Processing Records

12. Field records include field diary, site record for individual test pit/trench/square, context recording sheet, special finds recording sheet, soil sample & eco-facts sample recording sheet, map, survey sheet, photograph/ audio-visual records, etc.

13. Finds processing records include conservation record, measured drawings and photographs, laboratory reports, etc.

14. Measured drawing, both hard & soft copies (in pdf format), and photograph (in jpg format) of each special find should be handed over.

15. All the aforesaid records stated in paragraphs 12 to 14 should be handed over to the CAR when post-excavation research and excavation report have been completed. Please note:

- all the field records should be submitted together with indexes.
- the video footage should be submitted together with index describing the content of the video footage.
- all the slides, colour/ black & white negatives or digital photographs should be submitted together with photo register.

IV. Handover of Finds

16. Packing

- Each special find should be packed and protected with tissue paper, bubble sheet or P.E. foam to avoid shocking when transporting to the repository. No packing material other than the aforesaid items should be used.
- The general finds should be protected with bubble sheet or P.E. foam and packed in heavy duty plastic container.
- The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
- For oversized finds, prior advice on packing method should be sought from the AMO.

17. Handover procedure

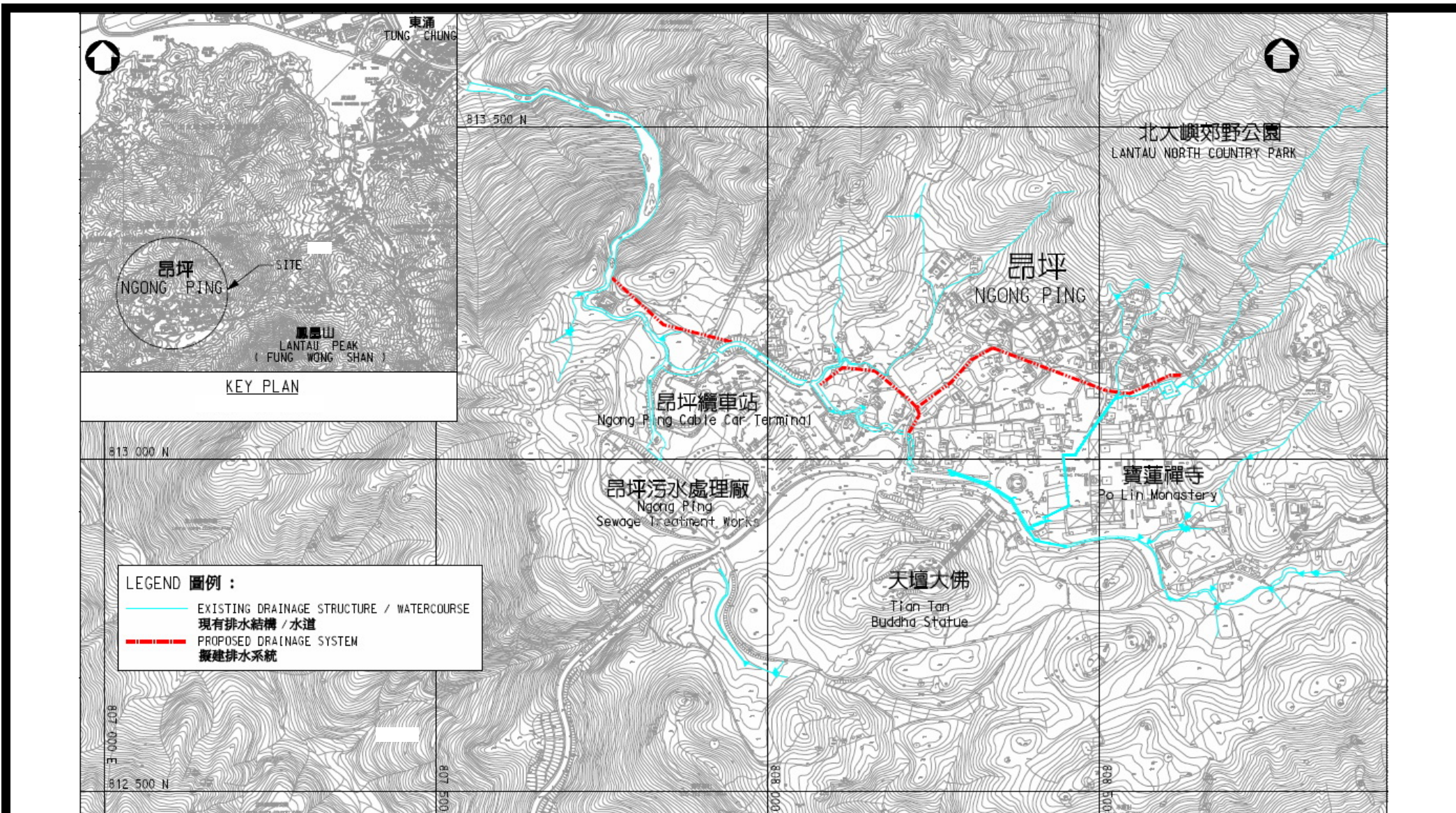
- The licensee should make an appointment with the CAR for the handover and arrange to transport the finds and archives to the repository.
- Prior to handover, licensee is required to supply with the aforesaid finds register, field records register and associated records to the CAR for checking at least three working days in advance. Exact date of handover will be arranged subsequently.
- Handover forms for finds and archives should be signed by the representatives of the licensee and the AMO.

Appendix J**Implementation Schedule of Recommended Mitigation Measures**

EIA Ref.	EM&A Ref.	Recommended Mitigation Measures	Objectives of the Recommended Measure & Main Concerns to address	Who to implement the measure?	Location of the measure	When to implement the measure?	What requirements or standards for the measure to achieve

Appendix K**Requirements for EIA Report Documents**

1. The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary :
 - (i) 50 copies of the EIA report and 80 copies of the bilingual (in both English and Chinese) executive summary as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report.
 - (ii) When necessary, addendum to the EIA report and the executive summary submitted in item (i) above as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
 - (iii) 20 copies of the EIA report and 50 copies of the bilingual (in both English and Chinese) executive summary with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.
2. To facilitate public inspection of EIA report via EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and executive summary shall be included in the beginning of the document. Hyperlinks to figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where respective references are made. Graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.
3. The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
4. When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
5. To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.



Project Title: Drainage Improvement Works at Ngong Ping

General Layout Plan (Originated from the Drawing (No. DDN8837) of Project Profile No. PP- 437/2011)

EIA Study Brief No.: ESB-227/2011

Figure 1

